UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/708,470	11/09/2000	Toshiro Sato	001399	1566

23850 7590 05/02/2003

ARMSTRONG,WESTERMAN & HATTORI, LLP
1725 K STREET, NW
SUITE 1000
WASHINGTON, DC 20006

EXAMINER	
SHARON, AYAL I	
ART UNIT	**PAPER NUMBER**
2123	5

DATE MAILED: 05/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/708,470	Applicant(s) SATO ET AL.
	Examiner Ayal I. Sharon	Art Unit 2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 09 November 2000 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-39 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-39 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 09 November 2000 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Introduction

1. Claims 1-36 of U.S. Application 09/708,470 filed on 11/09/2000, (and with a PCT priority date of 04/20/1999, and with a priority date of 05/14/1998 for Japanese Patent 10-132196), are presented for examination.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-36 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the types of noise listed in Figs.37A-37D, does not reasonably provide enablement for other types of noise. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims. It is not clear what other types of noise would be relevant.

5. Claims 1-36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
   - Claim 1 recites the limitation "each kind of noise" in p.116, line 12. There is insufficient antecedent basis for this limitation in the claim.
   - Claim 19 recites the limitation "each kind of noise" in p.126, line 15. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

   (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The prior art used for these rejections is as follows:
8. Purks, U.S. Patent 5,481,695. (Henceforth referred to as "**Purks**").
9. Carlson et al., U.S. Patent 6,128,769. (Henceforth referred to as "**Carlson**").
10. Rhodes, D.L. "Parallel Computation for Microwave Circuit Simulation". Transactions on Microwave Theory and Techniques. Vol.45, Issue 5. May '97. pp.587-592. (Henceforth referred to as "**Rhodes**").
11. Huang, U.S. Patent 5,568,395. (Henceforth referred to as "**Huang**").

12. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

13. **Claims 1-6, 13, 19-24, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Purks in view of Carlson.**

14. **Claims 7-8 and 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Purks in view of Carlson and further in view of Official Notice, and further in view of Rhodes.**

15. **Claims 9-12, 14, 27-30, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Purks in view of Carlson and further in view of Huang.**

16. In regards to Claim 1, Purks teaches the following limitations:

1. A noise checking method used upon circuit designing for checking noise which has an influence on a signal waveform which propagates in a noticed wiring line on a design object circuit, characterized in that it comprises the steps of:

(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

producing a simulation model of a circuit portion relating to the noticed wiring line;

(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

However, Purks only expressly teaches cross-talk noise, and not other types of noise as claimed in the following limitations.

Carlson, on the other hand, does expressly teach the use of switching noise as well as cross-talk noise.

performing a simulation using the simulation model to calculate a signal waveform which propagates in the noticed wiring line and calculate a noise waveform superposed on the signal waveform in the noticed wiring line for **each kind of noise**;

(Carlson, especially: col.3, lines 1-40; and col.4, lines 18-40)

synthesizing the signal waveform and the noise waveforms calculated for the individual kinds of noise with generation timings of the noise waveforms taken into consideration to obtain a noise composite waveform which is the signal waveform on which the noise is superposed; and
(Carlson, especially: col.3, line 52 to col.5, line 34;)

performing noise checking based on the noise composite waveform.
(Carlson, especially: Eq.1 in col.4; col.4, lines 18-40)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

17. In regards to Claim 2, Purks teaches the following limitations:

2. The noise checking method as set forth in claim 1, characterized in that, where an adjacent wiring line to the noticed wiring line is turned back in such a manner as to have a plurality of proximate portions which can electrically interfere with the noticed wiring line,
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

simulation models are produced with regard to the individual proximate portions of the adjacent wiring line and the noticed wiring line and the noise waveforms are calculated using the simulation models,
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

and then the noise waveforms calculated with regard to all of the proximate portions and the signal waveform are synthesized with generation timings of the noise waveforms taken into consideration.

(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

18. In regards to Claim 3, Purks does not expressly teach the following limitations.

However, Carlson does expressly teach the following limitations:

3. The noise checking method as set forth in claim 1, characterized in that, when the noise checking is performed,
(Carlson, especially: col.3, line 41 – col.5, line 17)

a maximum delay time and a minimum delay time of the noticed wiring line are extracted from the noise composite waveform,
(Carlson, especially: col.3, line 41 – col.5, line 17)

and
overdelay/racing checking for the noticed wiring line is performed using the maximum delay time and the minimum delay time.
(Carlson, especially: col.3, line 41 – col.5, line 17)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

19. In regards to Claim 4, Purks does not expressly teach the following limitations.

However, Carlson does expressly teach the following limitations:

4. The noise checking method as set forth in claim 1, characterized in that, where the signal waveform which propagates in the noticed wiring line is a clock waveform,
(Carlson, especially: col.3, line 41 – col.5, line 17)

when the noise checking

is performed, a pulse period of the noise composite waveform is calculated from crossing points of the noise composite waveform and a high level discrimination threshold value/low level discrimination threshold value for the signal waveform,
(Carlson, especially: Fig.4, Fig.5 and col.4, line 18 – col.4, line 40)

and pulse period checking of the clock waveforrn in the noticed wiring line is performed based on the pulse period.
(Carlson, especially: Fig.5 and col.5, lines 35-57)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

20. In regards to Claim 5, Purks does not expressly teach the following limitations. However, Carlson does expressly teach the following limitations:

5. The noise checking method as set forth in claim 1, characterized in that, where the signal waveform which propagates in the noticed wiring line is a clock waveform, when the noise checking is performed, a rising width and a falling width of the noise composite waveform are calculated from crossing points of the noise composite waveform and a high level discrimination threshold value/low level discrimination threshold value for the signal waveform, and pulse width checking of the clock waveform in the noticed wiring line is performed based on the rising width and the falling width.
(Carlson, especially: Fig.4, Fig.5 and col.3, line 41 – col.5, line 17)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing

problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

21. In regards to Claim 6, Purks does not expressly teach the following limitations. However, Carlson does expressly teach the following limitations:

6. The noise checking method as set forth in claim 1, characterized in that, where the signal waveform which propagates in the noticed wiring line is a clock waveform, when the noise checking is performed, a time required for the noise composite waveform to rise and another time required for the noise composite waveform to fall are calculated from crossing points of the noise composite waveform and a high level discrimination threshold value/low level discrimination threshold value for the signal waveform, and checking of the rising time/falling time of the clock waveform in the noticed wiring line is performed based on the times.
(Carlson, especially: Fig.4, Fig.5 and col.3, line 41 – col.5, line 17)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

22. In regards to Claim 7, Purks expressly teaches the use of UNIX-based stations on a network (see Purks, especially: Fig.3, Item 304; col.3, lines 36-41;). Official Notice is given that is well known in the art that the multi-threading and multi-tasking functions of UNIX operating system enable the creation of software

applications that can take advantage of the parallel processing capabilities of multi-processor machines such as Sun Microsystems™ workstations.

However, Purks does not expressly teach the following limitations:

7. The noise checking method as set forth in claim 1, characterized in that, when the simulation is performed, the simulation model is divided into a plurality of files, and simulations with regard to the plurality of files are executed individually by a plurality of processing sections of a parallel processor which operate parallelly, whereafter simulation result files by said plurality of processing sections are combined.

Rhodes does expressly teach the dividing of a simulation model into a plurality of files and running the files parallely on a parallel processor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with the teachings of Rhodes because "Typical MPC's [Massively Parallel Computers] allow for tens to several hundred or even thousands of nodes, and thus in principle offer the ability to apply a large amount of computational power and memory to a problem." (Rhodes, p.587, col.1, lines 4-7)

23. In regards to Claim 8, Purks expressly teaches the use of UNIX-based stations on a network (see Purks, especially: Fig.3, Item 304; col.3, lines 36-41;). Official Notice is given that is well known in the art that the multi-threading and multi-tasking functions of UNIX operating system enable the creation of software applications that can take advantage of the parallel processing capabilities of multi-processor machines such as Sun Microsystems™ workstations.

However, Purks does not expressly teach the following limitations:

8. The noise checking method as set forth in claim 1, characterized in that, when the simulation is performed, the simulation model is divided into a plurality of files, and simulations with regard to the plurality of files are executed individually by a plurality of processing sections interconnected over a network, whereafter simulation result files by said plurality of processing sections are combined.

Rhodes does expressly teach the dividing of a simulation model into a plurality of files and running the files parallely on a parallel processor. Moreover, Rhodes expressly teaches an implementation called "message passing" (p.588 and Fig.1(b) and Fig.1(c)), where processing nodes communicate with one another. This communication must inherently be on some sort of network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with the teachings of Rhodes because "Typical MPC's [Massively Parallel Computers] allow for tens to several hundred or even thousands of nodes, and thus in principle offer the ability to apply a large amount of computational power and memory to a problem." (Rhodes, p.587, col.1, lines 4-7)

24. In regards to Claim 9, Purks teaches the display of routing information:

9. The noise checking method as set forth in claim 1, characterized in that it further comprises the steps of:

performing a noise analysis with regard to the noise composite waveform;
(Purks, especially: Fig.4, Items 400, 410, 414 and 416)

Also, Purks teaches the use of a user interface, and more specifically, "a keyboard and/or mouse", both of which can be used to move a cursor ("pointing device") on the screen.

calculating, if the questionable wiring line displayed on said display section is moved on said display section by means of a pointing device, an actual movement amount of the questionable wiring line corresponding to an amount of the movement by said pointing device;
(Purks, especially: Fig.3, Item 300 and col.3, lines 12-25)

performing, in the state wherein the questionable wiring line is moved by the actual movement amount, the production of the simulation model, the simulation, the synthesis of the noise composite waveform and the noise checking again; and
(Purks, especially: Fig.3, Item 300 and col.3, lines 12-25)

displaying, if a questionable wiring line which has a bad influence on the noticed wiring line is found by the noise analysis , a wiring line pattern including the noticed wiring line and the questionable wiring line on a display section;
(Purks, especially: col.2, lines 25-59)

However, Purks does not expressly teach the display of rerouted circuit layout information.

Huang does expressly teach the display of rerouted circuit layout information:

displaying the noise composite waveform after the movement of the questionable wiring line on said display section.
(Huang, especially: Fig.2, Items 204, 206, 208, 210 and 212; and col.5, lines 50-62)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang,

because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

25. In regards to Claim 10, Purks teaches the following limitations:

10. The noise checking method as set forth in claim 1, characterized in that it further comprises the steps of:

performing a noise analysis with regard to the noise composite waveform;
(Purks, especially: Fig.4, Items 400, 410, 414 and 416)

Purks teaches the display of routing information (see Fig.4, Items 400, 410, and 414) in the limitations below. However, Purks does not expressly teach the display of rerouted circuit layout information.

Huang does expressly teach the display of rerouted circuit layout information:

displaying, if a noise waveform which has a bad influence on the noticed wiring line is found by the noise analysis, the noise waveform on a display section; and
(Huang, especially: Fig.2, Items 210 and 212; and col.5, lines 50-62)

calculating, if the noise waveform displayed on said display section is moved on said display section by means of a pointing device, a timing changing amount of the noise waveform corresponding to an amount of the movement by said pointing device and dynamically changing a generation timing of the noise waveform by the timing changing amount.
(Huang, especially: Fig.2, Items 210 and 212; and col.5, lines 50-62)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

26. In regards to Claim 11, Purks does not expressly teach the display of circuit-related noise data that has been dynamically changed due to re-routing.

Huang, on the other hand, does teach the following limitations:

11. The noise checking method as set forth in claim 10, characterized in that the synthesis of the noise composite waveform and the noise checking are performed again using the noise waveform whose generation timing has been dynamically changed, and the noise composite waveform after the timing changing of the noise waveform is displayed on said display section.

(Huang, especially: Fig.2, Items 204, 206, 208, 210 and 212; and col.5, lines 50-62)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

27. In regards to Claim 12, Purks does not expressly teach the calculation of pin resistance, and its effect on signal integrity. Huang, on the other hand, does teach the following limitations:

12. The noise checking method as set forth in claim 1, characterized in that it further comprises the steps of:

calculating, where ringing is superposed on the noise composite waveform, a damping resistance value with which the ringing can be eliminated if the damping resistor is added to the noticed wiring line;

displaying candidate part data corresponding to the damping resistance value on said display section;

performing, in a state wherein a part selected from among the candidate part data is added to the noticed wiring line, the production of the simulation model, the simulation, the synthesis of

the noise composite waveform and the noise checking again; and

displaying the noise composite waveform after the addition of the part on said display section.
(Huang, especially: col.9, line 23 - col.11, line 6)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

28. In regards to Claim 13, Purks does not expressly teach the distributions of the minimum and maximum values of time axis waveforms. Carlson does teach the following limitations:

13. The noise checking method as set forth in claim 1, characterized in that, in order to obtain the noise composite waveform,
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

time axis direction distributions of a maximum value and a minimum value of the signal waveform with a delay variation taken into consideration are calculated
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

and time axis direction distributions of a maximum value and a minimum value of a noise waveform with a noise generation timing variation taken into consideration are calculated for each kind of noise, and
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

time axis direction distributions of the maximum value and the minimum value obtained by synthesizing the time axis direction distributions of the maximum value and the minimum value of the signal waveform and the time axis direction distributions of the maximum value and the minimum value of the noise waveforms are used as the noise composite waveform.
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

29. In regards to Claim 14, Purks does not expressly teach checking if the minimum and maximum values of time axis waveforms satisfy the expected values for a check object pin.

Huang, on the other hand, does teach the calculation of resistance pin values, and determining circuit elements and delays, as claimed in the following limitations:

14. The noise checking method as set forth in claim 13, characterized in that, when the noise checking is performed, it is discriminated whether or not both of the time axis direction distributions of the maximum value and the minimum value of the noise composite waveform satisfy logical expected values for a check object pin.
(Huang, especially: col.9 line 23 to col.11, line 6; and Fig.2, Items 224, 226, 208, 212)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

30. In regards to Claim 19, Purks teaches the following limitations:

19. A noise checking apparatus used upon circuit designing for checking noise which has an influence on a signal waveform which propagates in a noticed wiring line on a design object circuit, characterized in that it comprises:
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

a model production section (3) for producing a simulation model of a circuit portion relating to the noticed wiring line;
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

However, Purks only expressly teaches cross-talk noise, and not other types of noise as claimed in the following limitations.

Carlson, on the other hand, does expressly teach the use of switching noise as well as cross-talk noise.

a simulation section (4) for performing a simulation using the simulation model produced by said model production section (3) to calculate a signal waveform which propagates in the noticed wiring line and calculate a noise waveform superposed on the signal waveform in the noticed wiring line for **each kind of noise**;
(Carlson, especially: col.3, lines 1-40; and col.4, lines 18-40)

a noise waveform synthesis section (5) for synthesizing the signal waveform and the noise waveforms calculated by said simulation section (4) with generation timings of the noise waveforms taken into consideration to obtain a noise composite waveform which is the signal waveform on which the noise is superposed; and
(Carlson, especially: col.3, line 52 to col.5, line 34;)

a noise checking section (6) for performing noise checking based on the noise composite waveform obtained by said noise waveform synthesis section (5).
(Carlson, especially: Eq.1 in col.4; col.4, lines 18-40)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

31. In regards to Claim 20, Purks teaches the following limitations:

20. The noise checking apparatus as set forth in claim 19, characterized in that, where an adjacent wiring line to the noticed wiring line is turned back in such a manner as to have a plurality of proximate portions which can electrically interfere with the noticed wiring line,
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

said model production section (3) produces simulation models with regard to the individual proximate portions of the adjacent wiring line and the noticed wiring line and said simulation section (4) calculates the noise waveforms using the simulation models,
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

and then said noise waveform synthesis section (5) synthesizes the noise waveforms calculated with regard to all of the proximate portions and the signal waveforrn with generation timings of the noise waveforms taken into consideration.
(Purks, especially: col.2, "Summary of the Invention"; col.3, lines 13-49; Fig.4, Items 400-414))

32. In regards to Claim 21, Purks does not expressly teach the following limitations.

However, Carlson does expressly teach the following limitations:

21. The noise checking apparatus as set forth in claim 19, characterized in that said noise checking section (6)

(Carlson, especially: col.3, line 41 – col.5, line 17)

extracts a maximum delay time
and a minimum delay time of the noticed wiring line
from the noise composite waveform
(Carlson, especially: col.3, line 41 – col.5, line 17)

and performs
overdelay/racing checking for the noticed wiring
line using the maximum delay time and the minimum
delay time.
(Carlson, especially: col.3, line 41 – col.5, line 17)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

33. In regards to Claim 22, Purks does not expressly teach the following limitations.

However, Carlson does expressly teach the following limitations:

22. The noise checking apparatus as set forth
in claim 19, characterized in that, where the signal
waveform which propagates in the noticed wiring
line is a clock waveform,
(Carlson, especially: col.3, line 41 – col.5, line 17)

said noise checking
section (6) calculates a pulse period of the noise
composite waveform from crossing points of the
noise composite waveform and a high level
discrimination threshold value/low level
discrimination threshold value for the signal
waveform
(Carlson, especially: Fig.4, Fig.5 and col.4, line 18 – col.4, line 40)

and performs pulse period checking of the
clock waveform in the noticed wiring line based on
the pulse period.
(Carlson, especially: Fig.5 and col.5, lines 35-57)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

34. In regards to Claim 23, Purks does not expressly teach the following limitations. However, Carlson does expressly teach the following limitations:

> 23. The noise checking apparatus as set forth in claim 1, characterized in that, where the signal waveform which propagates in the noticed wiring line is a clock waveform, said noisechecking section (6) calculates a rising width and a falling width of the noise composite waveform from crossing points of the noise composite waveform and a high level discrimination threshold value/low level discrimination threshold value for the signal waveform and performs pulse width checking of the clock waveform in the noticed wiring line based on the rising width and the falling width.

(Carlson, especially: Fig.4, Fig.5 and col.3, line 41 – col.5, line 17)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

35. In regards to Claim 24, Purks does not expressly teach the following limitations. However, Carlson does expressly teach the following limitations:

24. The noise checking apparatus as set forth in claim 1, characterized in that, where the signal waveform which propagates in the noticed wiring line is a clock waveform, said noise checking section (6) calculates a time required for the noise composite waveform to rise and another time required for the noise composite waveform to fall from crossing points of the noise composite waveform and a high level discrimination threshold value/low level discrimination threshold value for the signal waveform and performs checking of the rising time/falling time of the clock waveform in the noticed wiring line based on the times.
(Carlson, especially: Fig.4, Fig.5 and col.3, line 41 – col.5, line 17)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

36. In regards to Claim 25, Purks expressly teaches the use of UNIX-based stations on a network (see Purks, especially: Fig.3, Item 304; col.3, lines 36-41;). Official Notice is given that is well known in the art that the multi-threading and multi-tasking functions of UNIX operating system enable the creation of software applications that can take advantage of the parallel processing capabilities of multi-processor machines such as Sun Microsystems™ workstations.

However, Purks does not expressly teach the following limitations:

25. The noise checking apparatus as set forth in claim 19, characterized in that said simulation section (4) includes:

a file dividing section for dividing the simulation model into a plurality of files;

a parallel processor having a plurality of processing sections for executing simulations with regard to the plurality of files obtained by the division of said file dividing section parallelly; and

a file combining section for combining simulation result files by said plurality of processing sections.

Rhodes does expressly teach the dividing of a simulation model into a plurality of files and running the files parallely on a parallel processor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with the teachings of Rhodes because "Typical MPC's [Massively Parallel Computers] allow for tens to several hundred or even thousands of nodes, and thus in principle offer the ability to apply a large amount of computational power and memory to a problem." (Rhodes, p.587, col.1, lines 4-7)

37. In regards to Claim 26, Purks expressly teaches the use of UNIX-based stations on a network (see Purks, especially: Fig.3, Item 304; col.3, lines 36-41;). Official Notice is given that is well known in the art that the multi-threading and multi-tasking functions of UNIX operating system enable the creation of software applications that can take advantage of the parallel processing capabilities of multi-processor machines such as Sun Microsystems™ workstations.

However, Purks does not expressly teach the following limitations:

26. The noise checking apparatus as set forth in claim 19, characterized in that said simulation section (4) includes:

a file dividing section for dividing the simulation model into a plurality of files;

a network interconnecting a plurality of processing sections for executing simulations with regard to the plurality of files parallelly; and

a file combining section for combining simulation result files by said plurality of processing sections.

Rhodes does expressly teach the dividing of a simulation model into a plurality of files and running the files parallely on a parallel processor. Moreover, Rhodes expressly teaches an implementation called "message passing" (p.588 and Fig.1(b) and Fig.1(c)), where processing nodes communicate with one another. This communication must inherently be on some sort of network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with the teachings of Rhodes because "Typical MPC's [Massively Parallel Computers] allow for tens to several hundred or even thousands of nodes, and thus in principle offer the ability to apply a large amount of computational power and memory to a problem." (Rhodes, p.587, col.1, lines 4-7)

38. In regards to Claim 27, Purks teaches the display of routing information.

27. The noise checking apparatus as set forth in claim 19, characterized in that it further comprises:

a noise composite waveform analysis section for performing a noise analysis with regard to the noise composite waveform;

(Purks, especially: Fig.4, Items 400, 410, 414 and 416)

Also, Purks teaches the use of a user interface, and more specifically, "a keyboard and/or mouse", both of which can be used to move a cursor ("pointing device") on the screen.

a pointing device for moving the questionable wiring line displayed on said display section on said display section; and
(Purks, especially: Fig.3, Item 300 and col.3, lines 12-25)

a movement-amount-calculation section for calculating an actual movement amount of the questionable wiring line corresponding to an amount of the movement by said pointing device; and that,
(Purks, especially: Fig.3, Item 300 and col.3, lines 12-25)

a display section for displaying, if a questionable wiring line which has a bad influence on the noticed wiring line is found by said noise composite waveform analysis section, a wiring line pattern including the noticed wiring line and the questionable wiring line;
(Purks, especially: col.2, lines 25-59)

However, Purks does not expressly teach the display of rerouted circuit layout information.

Huang does expressly teach the display of rerouted circuit layout information:

in the state wherein the questionable wiring line is moved by the actual movement amount, said model production section (3), said simulation section (4), said noise waveform synthesis section (5) and said noise checking section (6) are operated again and the noise composite waveform after the movement of the questionable wiring line is displayed on said display section.
(Huang, especially: Fig.2, Items 204, 206, 208, 210 and 212; and col.5, lines 50-62)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

39. In regards to Claim 28, Purks teaches the following limitations:

28. The noise checking apparatus as set forth in claim 19, characterized in that it further comprises:

a noise composite waveform analysis section for performing a noise analysis with regard to the noise composite waveform;
(Purks, especially: Fig.4, Items 400, 410, 414 and 416)

Purks teaches the display of routing information (see Fig.4, Items 400, 410, and 414) in the limitations below. However, Purks does not expressly teach the display of rerouted circuit layout information.

Huang does expressly teach the display of rerouted circuit layout information:

a display section for displaying, if a noise waveform which has a bad influence on the noticed wiring line is found by said noise composite waveform analysis section, the noise waveform; and
(Huang, especially: Fig.2, Items 210 and 212; and col.5, lines 50-62)

a timing changing amount calculation section for calculating a timing changing amount of the noise waveform corresponding to an amount of the movement by said pointing device and dynamically changing a generation timing of the noise waveform by the timing changing amount.
(Huang, especially: Fig.2, Items 210 and 212; and col.5, lines 50-62)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

40. In regards to Claim 29, Purks does not expressly teach the display of circuit-related noise data that has been dynamically changed due to re-routing.

Huang, on the other hand, does teach the following limitations:

29. The noise checking apparatus as set forth

in claim 28, characterized in that said noise waveform synthesis section (5) and said noise checking section (6) are operated again in a state wherein the generation timing of the noise waveform is changed, and the noise composite waveform after the timing changing of the noise waveform is displayed on said display section.
(Huang, especially: Fig.2, Items 204, 206, 208, 210 and 212; and col.5, lines 50-62)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

41. In regards to Claim 30, Purks does not expressly teach the calculation of pin resistance, and its effect on signal integrity. Huang, on the other hand, does teach the following limitations:

30. The noise checking apparatus as set forth in claim 19, characterized in that it further comprises:

a damping resistance value calculation section for calculating, where ringing is superposed on the noise composite waveform, a damping resistance value with which the ringing can be eliminated if the damping resistor is added to the noticed wiring line;

a part searching section for searching for candidate part data corresponding to the damping resistance value calculated by said damping resistance value calculation section;

a displaying section for displaying the candidate part data searched out by said part searching section; and

a selective inputting section for selecting apart from among the candidate part data displayed on said display section; and that,

in a state wherein the part selected from among the candidate part data is added to the noticed

wiring line, said model production section (3), said simulation section (4), said noise waveform synthesis section (5) and said noise checking section (6) are operated again, and the noise composite waveform after the addition of the part is displayed on said display section.
(Huang, especially: col.9, line 23 - col.11, line 6)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

42. In regards to Claim 31, Purks does not expressly teach the distributions of the minimum and maximum values of time axis waveforms. Carlson does teach the following limitations:

31. The noise checking apparatus as set forth in claim 19, characterized in that said noise waveform synthesis section (5)
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

calculates time axis direction distributions of a maximum value and a minimum value of the signal waveform with a delay variation taken into consideration
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

and calculates time axis direction distributions of a maximum value and a minimum value of a noise waveform with a noise generation timing variation taken into consideration for each kind of noise, and
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

synthesizes the time axis direction distributions of the maximum value and the minimum value of the signal waveform and the time axis direction distributions of the maximum value and the minimum value of the noise waveforms to obtain time axis direction distributions of the maximum value and the minimum value as the noise composite waveform.
(Carlson, especially Fig.3-4, Items 300 and 400, and associated text)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Purks with those of Carlson, because in order "to more efficiently identify the signals that cause the timing problems, it is useful to perform timing filtering, logic filtering, cross-talk attacker filtering, and safety window filtering on the electronic circuits" (Carlson: col.3, lines 3-8).

43. In regards to Claim 32, Purks does not expressly teach checking if the minimum and maximum values of time axis waveforms satisfy the expected values for a check object pin.

Huang, on the other hand, does teach the calculation of resistance pin values, and determining circuit elements and delays, as claimed in the following limitations:

32. The noise checking apparatus as set forth in claim 31, characterized in that said noise checking section (6) discriminates whether or not both of the time axis direction distributions of the maximum value and the minimum value of the noise composite waveform satisfy logical expected values for a check object pin to perform the noise checking.
(Huang, especially: col.9 line 23 to col.11, line 6; and Fig.2, Items 224, 226, 208, 212)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Purks with those of Huang, because while Purks would identify the design problem, Huang's re-routing of the circuit would automatically solve the design problem.

Conclusion

44. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.

45. Okano et al., U.S. Patent 5,751,597. Teaches rerouting in response to noise, and has the same assignee as the instant application.

46. Sato, U.S. Patent 6,278,951. Teaches a method for calculating crosstalk noise, and has the same assignee as the instant application.

47. Miura et al., U.S. Patent 5,867,810. See claim 7, which teaches a wire pattern editing unit, and a noise analyzing unit, and has the same assignee as the instant application.

48. Goto, U.S. Patent 5,706,477. Teaches a circuit simulation and re-routing apparatus, and has the same assignee as the instant application.

49. Carlson et al., U.S. Patent 5,983,006. Similar to the reference used in the rejections.

50. Li et al., U.S. Patent 6,212,490. Teaches a circuit simulator for atiming and noise analysis.

51. Tsai et al., U.S. Patent 5,243,547. See claim 2. Teaches calculating crosstalk and switching noise in a circuit simulator.

52. Conn et al., U.S. Patent 5,999,714. Teaches incorporating noise considerations in circuit optimization.

53. Dansky et al., U.S. Patent 6,028,989. Teaches calculating crosstalk from routing data.

54. Lipman, Jim. "Board-Level Signal-Integrity Analysis: Sooner is Better" EDN Access. July 16, 1998. This reference is provided in order to "show the level of ordinary skill in the art at or around the time the invention was made." See MPEP §2124, *Ex parte Erlich,* 22 USPQ 1463 (Bd. Pat. App. & Inter. 1992). The reference provides a list of commercial products that were available at the time of the filing of the foreign patent applications.
55. Steinberg, C. and Wilson, I. "Simulation Programs Iron Out Transmission-Line Effects". EDN Access. March 3, 1994. Teaches cross-talk, transmission line effects, ringing (Fig.2), and noise margins (Fig.4, Fig.7).
56. Matsui et al. "Electrical Design Techniques for High-Speed Circuit Boards". 8th IEEE/CHMT Int'l Electronic Manufacturing Technology Symposium, 1990. May 9, 1990. pp.234-243. Teaches different noise signals (Fig.3), multiple cross-talk (Fig.4), post-layout simulation (Fig.6), and improved component placement (Fig.10).
57. Becker et al. "FDTD Modeling of Noise in Computer Packages". Proceedings, 1993 IEEE Multi-Chip Module Conference. March 18, 1993. pp.123-127. Teaches mathematical models for Crosstalk noise (section 2), Reflection noise (section 3), and Switching noise (Section 4).
58. Gao, et al. "Minimum Crosstalk Channel Routing". 1993 IEEE/ACM Int'l Conf. On CAD. Nov. 11, 1993. pp.692-696. Teaches circuit design simulation, as well as modification of designs in order to minimize cross-talk.

59. John, et al. "Methods for Simulation of Reflection and Crosstalk Effects on Printed Circuit Boards". 9th Int'l Conference on Electromagnetic Compatibility, 1994. Sept. 7, 1994. pp.217-224. Teaches the simulation of reflection and crosstalk noise on printed circuit boards.

60. Kyoung-Son, et al. "A Segment Rearrangement Approach to Channel Routing Under the Crosstalk Constraints". 1994 IEEE Asia-Pacific Conference on Circuits and Systems. Dec. 8, 1994. pp.536-541. Teaches segment re-arrangement in order to minimize crosstalk (e.g. Fig.3).

61. Huq, Syad. "Understanding and Using IBIS models for Signal Integrity Analysis". Presented at High-Level Electronic System Design Conference (HESDC '97). Oct. 7-9, 1997. Slides 15-18 teach Signal Integrity Analysis by testing for crosstalk, ringing, overshoot, undershoot, reflections, etc.

62. "IBIS", Printed Circuit Design Magazine, April 1997. Teaches that "The key parameters provided by an IBIS data file are ideally suited for automatic calculation of ringing and crosstalk".

63. "I/O Buffer Information Specification (IBIS) Version 3.0, (June 12, 1997). Teaches a detailed description of the IBIS standard.

64. ACCEL Technologies, Inc. "ACCEL Signal Integrity™ User Guide". 1998. Chapter 3 describes editing net specifications (pp.18-25), running reflection simulation (pp.40-51) and running crosstalk simulation (pp.52-63).

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (703) 306-0297. The examiner can normally be reached on Monday through Thursday, and the first Friday of a biweek, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on (703) 305-9704. Any response to this office action should be mailed to:

Director of Patents and Trademarks
Washington, DC 20231

Hand-delivered responses should be brought to the following office:

4th floor receptionist's office
Crystal Park 2
2121 Crystal Drive
Arlington, VA

The fax phone numbers for the organization where this application or proceeding is assigned are:

Official communications:	(703) 746-7239
Non-Official / Draft communications	(703) 746-7240
After Final communications	(703) 746-7238

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist, whose telephone number is: (703) 305-3900.

Ayal I. Sharon

Art Unit 2123

April 22, 2003

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER